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SYNOPSIS OF NORTH-AMERICAN INVERTEBRATES. VIII.

THE ISOPODA. — PART I.

CHELIFERA, FLABELLIFERA, VALVIFERA.

HARRIET RICHARDSON.

THE Isopoda represent an order of Crustacea widely distributed and varying greatly in their mode of life and in their habitat. They abound not only in the sea, where they are taken in shallow water and from the greatest depths, but large numbers of them are also found in ponds and streams and other bodies of fresh water. The terrestrial Isopoda form a large and important group, and are commonly known as "pill-bugs." Many of the Isopoda live a free existence, while others are parasitic. These latter are found in the mouths and gills of fishes, in the branchial cavities of Decapoda, on Copepoda, and on other Isopoda.

In the following key the marine forms have not been limited bathymetrically. Where it has been possible, the depth from which the specimens were taken has been given. The fresh-water and terrestrial forms are included.

The lettering for the distribution of species has been adopted in accordance with what has been used in former papers of this series of synopses on marine invertebrates: *A* for Alaska south; *P* for Puget Sound to San Francisco; *D* for Monterey to San Diego; *N*, Atlantic coast south to Cape Cod; *M*, Cape Cod to North Carolina; *S*, South Carolina to Florida; *G*, Gulf of Mexico.

The literature on the Isopoda has been limited in the following list to those papers which treat especially of North American forms. The most important of these are:

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1857. STIMPSON, WM. Crustacea and Echinodermata of the Pacific Shores of North America. *Journ. Boston Soc. Nat. Hist.* Vol. vi.
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1874. VERRILL, A. E., and SMITH, S. I. Report upon the Invertebrate Animals of Vineyard Sound. *Rept. U. S. Fish Comm. for 1871-1872*.
1875. STUXBERG, A. Om Nord-Amerikas Oniscider. *Ofversigt af Vetensk. Akad. Forhandl.*, No. 2.
1877. HARFORD. Description of a New Genus and Three New Species of Sessile-Eyed Crustacea, pp. 54, 55, and Descriptions of Three New Species of Sessile-Eyed Crustacea, with Remarks on *Ligia occidentalis*, pp. 116, 117. *Proc. California Acad. Sci.* 1876. Vol. vii.
1877. LOCKINGTON, W. N. Remarks on the Crustacea of the Pacific Coast, with Descriptions of Some New Species, p. 36, and Descriptions of Seventeen New Species of Crustacea, pp. 44-46. *Proc. California Acad. Sci.* 1876. Vol. vii.
1880. HARGER, OSCAR. Report on the Marine Isopoda of New England and Adjacent Waters. *Rept. U. S. Fish Comm. for 1878*.
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1887. HANSEN, H. J. Oversigt over det vestlige Grønlands Fauna af Malakostrake Havkrebsdyr. *Vidensk. Meddel. fra den Naturh. Foren. i. Kjøbh.* Pp. 177-198.
1897. BENEDICT, JAMES E. A Revision of the Genus *Synidotea*. *Proc. Acad. Nat. Sci. Philadelphia*. Pp. 389-404.
1898. BENEDICT, JAMES E. The Arcturidæ in the U. S. Nat. Museum. *Proc. Biol. Soc. Washington*. Vol. xii, pp. 41-51.
1898. BENEDICT, JAMES E. Two New Isopods of the Genus *Idotea* from the Coast of California. *Proc. Biol. Soc. Washington*. Vol. xii, pp. 53-55.
1898. WALKER, ALFRED O. Crustacea Collected by W. A. Herdman in Puget Sound, Pacific Coast of North America. *Trans. Liverpool Biol. Soc.* Vol. xii, pp. 279-281.

1898. CALMAN, W. T. On a Collection of Crustacea from Puget Sound. *Ann. New York Acad. Sci.* Vol. xi, No. 13, pp. 274-282.
1899. RICHARDSON, HARRIET. Key to the Isopods of the Pacific Coast of North America, with Descriptions of Twenty-two New Species. *Proc. U. S. Nat. Mus.* Vol. xxi, pp. 815-869.
1900. RICHARDSON, HARRIET. Key to the Isopoda of the Atlantic Coast of North America, with Descriptions of New Species. (In manuscript, to be published later.)

In addition to those mentioned, the works of G. O. Sars, H. J. Hansen, Schiøedte and Meinert, Stebbing and Budde-Lund, have been of much assistance in the compilation of this key.

SYNOPSIS OF THE ISOPODA.

- a.* Legs of the first pair cheliform. Uropoda terminal. Pleopoda, when distinctly developed, exclusively natatory. . . . I. CHELIFERA
- a'.* Legs of the first pair not cheliform.
- b.* Uropoda lateral.
- c.* Uropoda forming together with the terminal segment of the abdomen a caudal fan. Pleopoda for the most part natatory. . . . II. FLABELLIFERA
- c'.* Uropoda valve-like, inflexed, arching over the pleopoda, which, to a great extent, are branchial. III. VALVIFERA
- b'.* Uropoda terminal.
- c.* Free forms.
- d.* Pleopoda exclusively branchial, generally covered by a thin opercular plate (the modified first pair).
- IV. ASELOTA
- d'.* Pleopoda fitted for air-breathing. . V. ONISCOIDEA
- c'.* Parasitic forms. Pleopoda, when present, exclusively branchial in the adult form, and not covered by any operculum.

VI. EPICARIDEA

I. CHELIFERA.

- a.* Body scarcely attenuated behind. Mandibles without palp. Anterior maxillæ with only a single masticatory lobe and a one-jointed palp; posterior ones quite rudimentary. Epignath of maxillipeds narrow, falciform. Superior antennæ with one multi-articulate flagellum. Second pair of legs ambulatory in character. . Family I. Tanaidæ
- a'.* Body narrow, produced, depressed. Mandibles with a three-jointed palp. Anterior maxillæ with two masticatory lobes and a two-jointed palp; posterior ones well developed and setose. Epignath of maxillipeds large, laminar, branchial in character. Superior antennæ with two multi-articulate flagella. Second pair of legs with a large, broad, flat hand, for burrowing purposes. . Family II. Apseudidæ

FAMILY I. TANAIIDÆ.

a. Pleopoda only three pairs. Uropoda simple, short, single-branched.

Tanais Audouin and Edwards

a'. Pleopoda five pairs. Uropoda double-branched.

b. Eyes wanting.

c. Inner branch of uropoda two to three-jointed. Pleopoda in female very small or rudimentary.

d. Incubatory pouch formed only by two lamellæ issuing from bases of fourth pair of legs. Pleopoda in female rudimentary. Gnathopods alike in both sexes. Mandibles well developed, with cutting edge coarsely dented. Cryptocope G. O. Sars

d'. Incubatory pouch normal. Pleopoda in female small, sometimes wanting. Gnathopods in female of normal appearance, hand dilated, fingers strong, thumb serrulated, in male slender, fingers simple. Mandibles very small and feeble in structure, with cutting edge narrow. Leptognathia G. O. Sars

c'. Inner branch of uropoda eight to nine-jointed. Pleopoda well developed. . . . Aloatanais Norman and Stebbing

b'. Eyes present.

c. Gnathopods in male imperfectly chelate, without any finger, or with finger very short and immovable.

Heterotanais G. O. Sars

c'. Gnathopods in male with chelæ fully developed.

d. Gnathopods in male sometimes very much elongated, with carpus attenuated, hand very large, oblong, finger elongate and curved, immovable, strongly tuberculate within. Thoracic appendages not specialized into an anterior and a posterior series. Marsupium of female formed of eight large lamellæ from the four first free segments.

Leptochelia Dana

d'. Gnathopods in male with chelæ very stout, the distal section of the penultimate joint extremely broad, with a toothed margin. Thoracic appendages specialized into an anterior and a posterior series. Marsupium of the female of the normal structure.

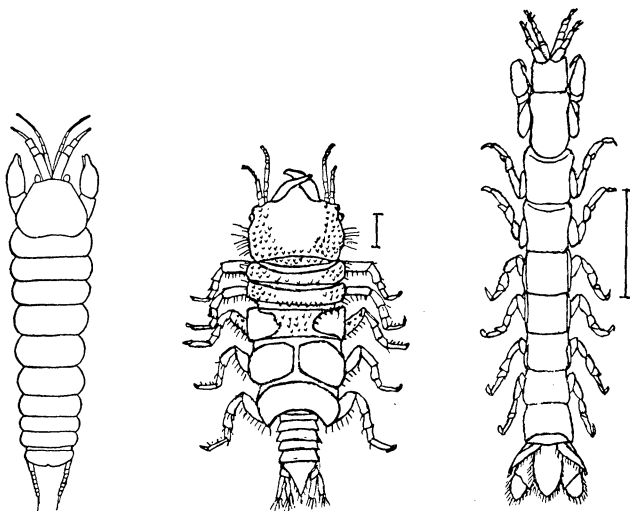
Neotanais Beddard

Genus Tanais Audouin and Edwards.

a. Periopoda having the first three joints short and broad, dilated and affixed to the sides of the thorax like plates of mail.

Tanais loricatus Spence Bate, *A*, 10 fms.

a'. Periopoda, with joints not dilated, slender.

FIG. 1. — *Tanais alascensis*.FIG. 2.¹ — *Gnathia cerina*.FIG. 3.¹ — *Cyathura carinata*.

b. Abdomen composed of six segments. Body robust and tapering.

Tanais robustus Moore, *M*

b'. Abdomen composed of five distinct segments. Body slender, elongated.

c. With transverse setiferous bands crossing first and second abdominal segments. Terminal segment with a blunt median projection. Uropoda three-jointed.

Tanais cavolinii Milne Edwards, *N*

c'. Without transverse setiferous bands crossing first and second abdominal segments. Terminal segment with slight median notch. Uropoda seven-jointed.

Tanais alascensis Richardson, *A*, 6–8 fms.

Genus *Cryptocope* G. O. Sars. . *Cryptocope arctica* Hansen, *N*, 170 fms.

Genus *Leptognathia* G. O. Sars.

a. In female inner branch of uropoda twice as long as outer. The second or first free segment of thorax is about two-thirds as long as the third, which in turn is about equal to the fourth and fifth. Sixth and seventh segments are progressively somewhat shorter. Propodus of first pair of legs less robust than carpus.

Leptognathia cæca (Harger), *N*, surface to 48 fms.

a'. In female inner branch of uropoda more than three times as long as outer. The second, or first free segment of thorax about same size as the last one, both being shorter than the others. Propodus of first pair of legs scarcely smaller than carpus.

Leptognathia longiremus (Lilljeborg), *N*, 35–40 fms.

¹ Figures taken from O. Harger.

Genus *Aloatanais* Norman and Stebbing.

Aloatanais hastiger Norman and Stebbing, *N*, 1750 fms.

Genus *Heterotanaïs* G. O. Sars. *Heterotanaïs limnicola* Harger, *N*, 48 fms.

Genus *Leptochelia* Dana.

a. Gnathopods in male greatly elongated, with tuberculate immobile finger. Upper antennæ three-jointed, with rudimentary flagellum in female, much more elongated, and with a multi-articulate flagellum in male.

b. Inner branch of uropoda five-jointed. Antennulæ, with basal segment nearly one-half length of the whole organ, are more than one-third as long as the body.

Leptochelia rapax Harger, *N*, one-half fm.

b'. Inner branch of uropoda six-jointed. Antennulæ, with basal segment about one-third length of the whole organ, are about two-thirds as long as body.

Leptochelia savignyi (Krøyer), *N*, surface

a'. Gnathopods in male not greatly elongated. Upper antennæ three-jointed, not elongated in male.

b. Inner branch of the uropoda five-jointed. Terminal abdominal segment rounded behind.

Leptochelia (?) *filum* (Stimpson), *N*, 8 fms.

b'. Inner branch of the uropoda six-jointed. Terminal abdominal segment pointed posteriorly.

Leptochelia dubia (Krøyer), *N*, surface to one-half fm.

Genus *Neotanaïs* Beddard. *Neotanaïs americanus* Beddard, *M*, 1240 fms.

FAMILY II. APSEUDIDÆ.

a. Lower antennæ with a scale articulated to the end of the second joint. First free segment of the thorax with epimera conspicuous, spine-formed, porrected. First five pair of pleopoda with both branches usually one-jointed. Exopods on both pairs of gnathopods.

Apseudes Leach

a'. Lower antennæ without a scale. Carapace composed of head and two following segments coalesced. Sphyrapus Norman and Stebbing
Genus *Apseudes* Leach.

Apseudes gracilis Norman and Stebbing, *N*, 1750 fms.

Genus *Sphyrapus* Norman and Stebbing.

Sphyrapus malleolus Norman and Stebbing, *N*, 1450 fms.

II. FLABELLIFERA.

a. Legs in the adult in six, apparently only in five pairs.

Family III. Gnathiidæ

a'. Legs in the adult in seven pairs.

- b.* Uropoda lateral and superior, outer branch arching over base of telson. Body cylindrical, narrow, elongated.

Family IV. Anthuridæ

- b'.* Uropoda lateral.

- c.* Abdomen consisting of six segments.

- d.* Uropoda with both branches developed; mostly lamelliform.

- e.* Maxillipeds with the palp free, the margins of the last two joints more or less setose, never furnished with hooks.

- f.* Mandibles with the distal half stout, very conspicuous, uncovered, or with only the anterior margin concealed; from the base towards the middle directed forwards and a little outwards.

- g.* Mandibles with the rather broad, more or less tridentate, cutting edges meeting squarely behind the large upper lip; the secondary plate and peculiar equivalent for the molar well developed. First maxillæ having the plate of the first joint armed with three spines, that of the third with many. Second maxillæ of moderate size, the three free plates very setose. Maxillipeds with the palp rather broad, very setose.

Family V. Cirolanidæ

- g'.* Mandibles with the distal part produced into a long prominent process, the pair much overlapping; the secondary plate and molar evanescent. First maxillæ having the plate of the first joint unarmed, of the third, carrying one very long spine. Second maxillæ small and feeble, the free plates almost rudimentary, with few setæ. Maxillipeds with the palp narrowed, not very setose.

Family VI. Corallanidæ

- f.* Mandibles with the distal half narrow, most or all of it concealed by the upper and lower lips; from the base towards the apex directed gradually inwards.

Family VII. Alcironidæ

- e'.* Maxillipeds with the palp embracing the cone formed by the distal parts of the mouth organs,

the inner upper margin and apex never setose, the apex and sometimes the inner upper margin, at least in the males and females without eggs, being furnished with outward curved hooks.

f. Mandibles with the secondary plate very often visible; palp with no inflated joint. Maxillipeds commonly seven-jointed, sometimes four-jointed, the last joint in the latter case rather short, obtuse. Antennæ long, unequal, with well-defined peduncle and flagellum. . . . Family VIII. *Ægidæ*

f'. Mandibles with no secondary plate; the palp in adults with first joint or both first and second joints inflated. Maxillipeds always four-jointed, last joint rather long and narrow, subacute. Antennæ much reduced without clear distinction between peduncle and flagellum. Family IX. *Cymothoidæ*

d'. Uropoda with one of the branches almost obsolete or rudimentary — not lamelliform.

Family X. *Limnoriidæ*

c'. Abdomen consisting of less than six segments.

d. Abdomen with two segments. Uropoda with one branch fixed, immovable. Family XI. *Sphæromidæ*

d'. Abdomen with four segments. Uropoda with both branches movable. . . . Family XII. *Serolidæ*

FAMILY III. GNATHIIDÆ.

Genus *Gnathia* Leach.

a. Mandibles in male with the basal part ornamented on the superior margin with an elevated crest, which is irregularly dentate. Legs furnished with many spiny processes. *Gnathia cristata* (Hansen), *N*, 116 fms.

a'. Mandibles in male without elevated crest on the superior margin. Legs without spiny processes.

b. Mandibles in male with slight notch outside, inner edge obtusely produced in the middle, tip acute, slightly incurved. Front of head not produced in the middle beyond the antero-lateral angles. . . . *Gnathia elongata* (Krøyer), *N*

b'. Mandibles in male carinate on outer side near the middle, the carina ending in a tooth-like process, irregularly and bluntly toothed near the base within, turned upward at apex. Front of head produced in the middle much beyond the antero-lateral angles.

Gnathia cerina (Stimpson), *N*, 10–220 fms. (See Fig. 2, p. 211.)

FAMILY IV. ANTHURIDÆ.

a. Labium terminating in two rounded lobes. Mandibles with cutting edge of two or three blunt teeth, and a semicircular saw in place of molar and spine row; palp three-jointed. First maxillæ simple, with apical teeth. Maxillipeds with three to six broad, flattened joints.

b. First five segments of the abdomen coalesced into a single segment in the female.

c. Maxillipeds three-jointed. Flagella of both pairs of antennæ few jointed in female; of first multi-articulate in male.

Anthura Leach

c'. Maxillipeds four-jointed. Flagella of both pairs of antennæ rudimentary, of the first pair not greatly developed in the male. Cyathura Norman and Stebbing

b'. Segments of abdomen distinct. Maxillipeds six-jointed.

Anthelura Norman and Stebbing

a'. Labium terminating in two points, acuminate. Mandibles without teeth, lancet-like, lobes at base forming channel. First maxillæ spear-like, distally channeled and serrate. Maxillipeds elongate, with four to five joints, the second of which is elongate. Abdomen with six segments and caudal segment distinct. Antennæ in both sexes with many jointed flagella. Calathura Norman and Stebbing

Genus Anthura Leach. *Anthura tenuis* (Harger), *N*, surface to 19 fms.

Genus Cyathura Norman and Stebbing.

Cyathura carinata (Krøyer), *NM*, surface to 19½ fms. (See Fig. 3, p. 211.)

Genus Anthelura Norman and Stebbing.

Anthelura abyssorum Norman and Stebbing, *N*, 1750 fms.

Genus Calathura Norman and Stebbing.

Calathura branchiata (Stimpson), *N*, 20-200 fms.

FAMILY V. CIROLANIDÆ.

a. Peduncle of the second antennæ five-jointed. Plate of the second joint of the maxillipeds furnished with hooks.

b. Eyes present. Uropoda with the inner angle of the peduncle produced.

c. First and second pairs of pleopoda equal in length, with at least the inner branch submembranaceous.

Cirolana Leach

c'. First pair of pleopoda with both branches hard, and forming a large operculum. Second pair of pleopoda submembranaceous. Conilera Leach

b'. Eyes wanting. Uropoda with the inner angle of the peduncle not produced. Cirolanides Benedict

a'. Peduncle of second antennæ four-jointed. Plate of second joint of maxillipeds without hooks. Uropoda with inner angle of peduncle very little produced. Pleopoda with both branches submembranaceous. Superior antennæ with first joint of peduncle quite short, and extended straight in front at a right angle to remaining part of the antenna. Eurydice Leach

Genus *Cirolana* Leach.

a. Fifth abdominal segment with lateral angles free, not covered by the fourth segment. . . *Cirolana linguifrons* Richardson, *D*, surface

a'. Fifth abdominal segment with lateral angles covered by fourth segment.

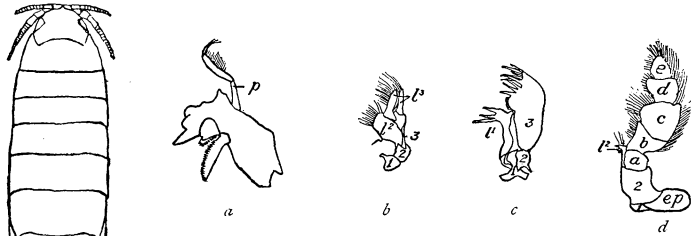


FIG. 5.1—*a*, Mandible of *Cirolana borealis*; *p*, palpus. *b*, Maxilla of the second pair; *1*, first joint; *2*, second joint; *l*², lobe of the second joint; *3*, third joint; *l*³, lobes of the third joint. *c*, Maxilla of the first pair; *1*, first joint; *l*¹, lobe of the first joint; *2*, second joint; *3*, third joint. *d*, Maxilliped; *1*, first joint; *ep*, epignath; *2*, second joint; *l*², lobe of the second joint; *a*, *b*, *c*, *d*, *e*, palpus.

FIG. 4.1—*Cirolana concharum*.

b. Frontal lamina posteriorly or clypeus anteriorly produced horn-like, especially so when seen from the side.

Cirolana virginiana Richardson, *M*, 81 fms.

b'. Frontal lamina and clypeus unarmed, not produced horn-like; anterior margin of the clypeus connected with the frontal lamina.

c. Frontal lamina narrow, elongate, four to six times longer than broad.

d. Extremity of exterior margin of inner branch of the uropoda emarginate.

e. Terminal segment emarginate at its extremity.

Cirolana concharum (Stimpson), *NM*, surface to 18 fms.

e'. Terminal segment not emarginate at its extremity.

Cirolana impressa Harger, *M*, 115–321 fms.

d'. Extremity of exterior margin of inner branch of the uropoda not emarginate.

e. Second pair of antennæ long, extending beyond the posterior margin of the third thoracic segment. *Cirolana borealis* Lilljeborg, *S*, 233 fms.

¹ Figures taken from Hansen.

ε'. Second pair of antennæ short, reaching to the middle of the first thoracic segment.

Cirolana polita Harger, *N*, 17-190 fms.

ε'. Frontal lamina broad, short, scarcely twice as long as wide.

d. Terminal segment with the posterior margin armed with many (twenty-six) robust spines. Branches of uropoda with apex rounded.

Cirolana harfordi (Lockington), *APD*, surface to 40 fms.

d'. Terminal segment with the posterior margin armed with a few slender spines. Branches of uropoda with apex acute.

Cirolana parva Hansen, *G*, 25-27 fms.

Genus *Conilera* Leach.

Conilera cylindracea (Montague), *SG*, 111-159 fms.

Genus *Cirolanides* Benedict.

Cirolanides texensis Benedict, Texas, fresh-water

Genus *Eurydice* Leach.

α. Second pair of antennæ in male extend to the posterior margin of fourth abdominal segment; flagellum consists of twenty-five joints. Terminal segment truncate between the post-lateral teeth.

Eurydice caudata Richardson, *D*

α'. Second pair of antennæ in male extend the entire length of the body; flagellum consists of eighteen joints. Terminal segment rounded between the post-lateral teeth. . . *Eurydice convexa* Richardson, *G*

FAMILY VI. CORALLANIDÆ.

Genus *Corallana* Dana. *Corallana truncata* Richardson, *D*

FAMILY VII. ALCIRONIDÆ.

Genus *Alcirona* Hansen. . . . *Alcirona krebsii* Hansen, *G*, 25-28 fms.

FAMILY VIII. ÆGIDÆ.

α. Body rather compact. Superior antennæ short, with first two peduncular joints more or less expanded. Epistome large, linguiform, projecting between the bases of inferior antennæ. Maxillipeds with palp composed of five joints. Front separating the whole or a great part of the first article of the first pair of antennæ. Flagellum of the first pair of antennæ composed of many joints. Abdomen compact. *Æga* Leach

α'. Body depressed. Superior antennæ short, with basal joints not expanded. Epistome very small and narrow. Maxillipeds with palp composed of only two joints. Front covering more or less the

peduncle of the first pair of antennæ. Flagellum of first pair of antennæ composed of four to six joints. Abdomen relaxed.

- b.* Eyes present. Anterior pairs of legs with propodus more or less expanded, dactylus forming a very large and evenly curved hook. Mandibles with the cutting edge expanded inside to a linguiform lamella; palp well developed, with basal joint much elongated. Abdomen not much narrower than thorax.

Rocinela Leach

- b'.* Eyes wanting. Anterior pairs of legs with propodus not expanded, dactylus abruptly curved in the middle, and terminating in a very sharp point. Mandibles with the cutting edge simple, acuminate; palp of moderate length. Abdomen narrowing abruptly to a much smaller width than the thorax; terminal segment very large. Syscenus Harger

Genus *Æga* Leach.

- a.* Peduncle of the first pair of antennæ plane or concave, joints fitting into each other. Frontal lamina plane or concave.

- b.* Terminal segment of body pointed at extremity. Eyes distant.

Æga psora (Linn), *N*, 30-218 fms.

- b'.* Terminal segment of body not pointed at extremity.

- c.* Terminal segment posteriorly bisinuate. Surface of segment smooth, without carinæ.

Æga ecarinata Richardson, *G*, 88 fms.

- c'.* Terminal segment emarginate or truncate.

- d.* Terminal segment emarginate. Eyes distant.

Æga webbii Guérin, *S*, 333 fms.

- d'.* Terminal segment truncate.

- e.* Eyes contiguous. Propodus of the posterior prehensile legs with a cultriform lamina.

Æga crenulata Lütken, *N*

- e'.* Eyes not contiguous. Propodus of posterior prehensile legs without cultriform lamina.

Æga lecontii (Dana), *D*

- a'.* Peduncle of the first pair of antennæ well rounded and with joints compressed. Frontal lamina convex or compressly elevated.

- b.* Eyes contiguous. Terminal segment incised.

Æga incisa Schiøedte and Meinert, *S*, 263-440 fms.

- b'.* Eyes not contiguous.

- c.* Terminal segment linguæ, incised posteriorly.

Æga arctica Lütken, *N*.

- c'.* Terminal segment triangular, entire.

- d.* Terminal segment, with apex rounded.

Æga microphthalma Dana, *D*

- d'.* Terminal segment, with apex produced.

Æga ventrosa Sars, *N*, 120 fms.

Genus *Rocinela* Leach.

- a.* Eyes contiguous. Head produced into process in front.
Rocinela oculata Harger, *S*, 252 fms.
- a'.* Eyes not contiguous. Flagellum of second pair of antennæ with fourteen to sixteen joints.
- b.* Propodus of prehensile legs with two to four spines.
- c.* First thoracic segment with antero-lateral angles produced horn-like at sides of head. Frontal margin of head produced. . . *Rocinela cornuta* Richardson, *A*, 625 fms.
- c'.* First thoracic segment normal. Frontal margin of head not produced.
- d.* Spots present on both sides of the fourth thoracic segment. *Rocinela maculata* Schiøedte and Meinert, *N*
- d'.* Spots wanting on fourth thoracic segment.
- e.* Spots present on fourth and fifth abdominal segment and base of terminal segment.
- Rocinela bellicepts* (Stimpson), *APD*, surface to 138 fms. (See Fig. 6, p. 221.)
- e'.* Spots wanting on fourth and fifth abdominal segments and base of terminal segment.
- Rocinela americana* Schiøedte and Meinert, *NM*, 85-157 fms.
- b'.* Propodus of prehensile legs with five to six spines.
Rocinela laticauda Hansen, *APD*, 82-660 fms.
- Genus *Syscenus* Harger. . . *Syscenus infelix* Harger, *M*, 231-435 fms.

FAMILY IX. CYMOTHOIDÆ.

- a.* Head not at all immersed or set in the first thoracic segment.
- b.* Uropoda and terminal segment ciliated. Eyes large, conspicuous.
Egathoa Dana
- b'.* Uropoda and terminal segment not ciliated. Eyes small.
- c.* Posterior angles of first thoracic segment prominent or produced, very often acute; posterior angles of the following segments increasing gradually in length, the first of these very often scarcely prominent, the posterior ones very often produced, abruptly longer than the first. Epimera of the first segments extending beyond the posterior angles of the segment; posterior ones produced, acute. *Nerocila* Leach
- c'.* Posterior angles of first six thoracic segments scarcely or not at all prominent; those of the seventh segment produced. Epimera of first segments very often almost or quite reaching, or not reaching by a short distance the posterior angle of the segment.
- d.* Body compact. Head not constricted. Uropoda very often more or less longer than terminal segment. Legs gradually increasing in length. *Anilocra* Leach

- d.* Body relaxed. Head constricted at the base. Uropoda much shorter than terminal segment. Legs gradually much longer successively; seventh pair abruptly very much so. Olencira Leach
- a.* Head more or less immersed or set in the first thoracic segment.
- b.* First pair of antennæ contiguous at the base.
- c.* Epimera of the first pair with a carina produced in the form of a spoon. Ungulæ very long, unequal in length; those of the third pair longest, abruptly longer than second pair. Terminal segment transverse. Ceratothoa Dana
- c.* Epimera of the first pair not produced. Ungulæ mostly very short, very rarely long, equal in length. Terminal segment subtriangular, semicircular, often bilobed.
Meinertia Stebbing
- b.* First pair of antennæ manifestly distant at the base.
- c.* Abdomen manifestly separated from the thorax, abruptly narrower than thorax. Cymothoa Fabricius
- c.* Abdomen contiguous with thorax, not narrower than thorax.
Livoneca Leach

Genus *Ægathoa* Dana.

- a.* Surface of head smooth, evenly convex. Second pair of antennæ ten-jointed. First thoracic segment longer than any of the succeeding segments, which are of equal length.
Ægathoa loliginea Harger, *M*
- a.* Surface of head with central portion sharply raised above the lateral portion, which is deeply excavate just in front of the eyes. Second pair of antennæ eight-jointed. First three thoracic segments subequal; last four subequal, and somewhat shorter than first three.
Ægathoa medialis Richardson, *M*, 3-25 fms.

Genus *Nerocila* Leach.

- a.* Terminal segment regularly rounded. Head subtruncate in front. Eyes distinct, black. *Nerocila munda* Harger, *N*
- a.* Terminal segment cordate, acuminate. Head rounded in front. Eyes indistinct, obscurely defined.
- b.* Uropoda scarcely longer than the apex of the terminal segment.
Nerocila acuminata Schiøedte and Meinert, *GSM*
- b.* Uropoda much longer than the apex of the terminal segment.
Nerocila californica Schiøedte and Meinert, *D*

Genus *Anilocra* Leach.

- a.* Terminal abdominal segment regularly rounded. All the epimera extend fully to the posterior angles of their corresponding segments. Branches of uropoda longer than terminal segment.
Anilocra occidentalis Richardson, *D*, 19 fms. (See Fig. 7, p. 221.)
- a.* Terminal abdominal segment subcordate. Two first epimera reach the posterior angles of the segments; last four do not reach the angles

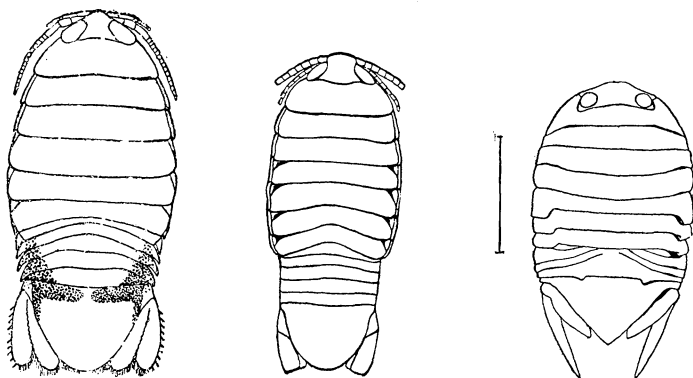


FIG. 6. — *Rocinela bellicepts*. FIG. 7. — *Anilocra occidentalis*. FIG. 8. — *Tecticeps alascensis*.

of the segments. Branches of the uropoda much shorter than terminal segment. . . . *Anilocra laticauda* Milne Edwards, *MS*
 Genus Olencira Leach. . . . *Olencira prægustator* (Latrobe), *MSG*
 Genus Ceratothoa Dana. . . . *Ceratothoa linearis* Dana, *M*
 Genus Meinertia Stebbing. *Meinertia transversa* Richardson, *G*, 347 fms.
 Genus Cymothoa Fabricius.

a. Terminal segment lanceolate. . . . *Cymothoa lanceolata* Say, *M*
a'. Terminal segment transverse; posterior margin widely sinuated or bilobed.

b. Anterior angles of the first thoracic segment short, acute; sides of the segment a little constricted. Inner branch of the uropoda much shorter than outer branch.

Cymothoa excisa Perty, *MSG*

b'. Anterior angles of the first thoracic segment very large, equaling or surpassing the front of the head, rounded. Sides of the segment flexuous. Inner branch of the uropoda manifestly longer than outer branch. . . *Cymothoa æstrum* (Linn), *M*

Genus Livoneca Leach.

a. Abdomen immersed in thorax, the sides of the first segment being almost entirely covered by the seventh thoracic segment.

b. Head narrowly rounded in front.

Livoneca californica Schiøedte and Meinert, *PD*

b'. Head broad, roundly truncate in front.

Livoneca vulgaris Stimpson, *D*

a'. Abdomen not immersed in thorax, the sides of the first segment free.

b. Uropoda much longer than caudal segment; inner branch narrow, obtuse, much shorter than outer branch. Epimera of last two thoracic segments not longer than segments.

Livoneca redmanni Leach, *SG*

- b'*. Uropoda hardly surpassing the caudal segment; both branches equal in length. Epimera of last two segments of thorax surpassing the segments. Head narrowly rounded in front. . . . *Livoneca ovalis* (Say), *NMSG*

FAMILY X. LIMNORIIDÆ.

Genus *Limnoria* Leach. . . . *Limnoria lignorum* (Rathke), *ANMS*

FAMILY XI. SPHÆROMIDÆ.

- a*. Outer branch of the uropoda small, almost rudimentary.

Cassidena Milne Edwards

- a'*. Outer branch of the uropoda not rudimentary.

- b*. Both external and internal branches of the uropoda projecting and exposed; outer branch capable of folding under inner.

- c*. Terminal segment of the abdomen entire.

- d*. Margins of the head not produced. Antennæ conspicuous. Legs normal. Mandibles with a five-jointed palp. *Sphæroma* Latreille

- d'*. Anterior and lateral margins of the head produced, concealing the antennæ. Propodus of first and second pairs of legs dilated, with reflexed dactylus. Mandibles with a three-jointed palp. . . . *Tecticeps* Richardson

- c'*. Terminal segment of the abdomen excavated at its extremity.

Dynamene Leach

- b'*. Only the external branch of the uropoda projecting and exposed; outer branch incapable of folding under inner.

- c*. All the thoracic segments of equal length. Penultimate abdominal segment in male generally produced in spine. Terminal segment excavated with or without median lobe.

Cilicæa Leach

- c'*. Sixth segment of the thorax much enlarged, and produced at the center far backwards, covering the shorter seventh segment for the most part. Terminal segment excavate.

Næsa Leach

Genus *Cassidena* Milne Edwards. . . . *Cassidena lunifrons* Richardson, *M*

Genus *Sphæroma* Latreille.

- a*. Body widening gradually from head backwards. Thorax transversely ridged and provided with three longitudinal rows of small tubercles. Branches of the uropoda very large, expanded.

Sphæroma amplicauda Stimpson, *APD*, surface

- a'*. Body not increasing in width. Surface of thorax smooth. Branches of the uropoda not expanded.

- b*. Extremity of terminal abdominal segment produced in a rhomboid process. *Sphæroma rhomburum* Richardson, *D*

b'. Extremity of terminal abdominal segment not produced.

c. Surface of abdomen tubercular.

d. Uropoda not reaching apex of terminal segment ; outer branch the shorter and not denticulate. Terminal segment with eight tubercles.

Sphæroma octoncum Richardson, *D*

d'. Uropoda surpassing the apex of the terminal segment ; outer branch the longer and provided with four teeth on external margin. Terminal segment with four tubercles.

Sphæroma destructor Richardson, Florida fresh-water

c'. Surface of abdomen smooth.

d. Outer branch of the uropoda denticulate on its external margin.

Sphæroma quadridentatum Say, *MS*, surface to $\frac{1}{2}$ fm.

d'. Outer branch of the uropoda not denticulate.

e. Outer branch of the uropoda half as long as the inner branch, and half as wide.

Sphæroma thermophilum Richardson, New Mexico, fresh-water

e'. Outer branch of the uropoda not much shorter than inner branch, and of equal width.

Sphæroma oregonensis Dana, *APD*, surface to 12 fms.

Genus *Tecticeps* Richardson.

a. Terminal segment of abdomen pointed. Outer branch of uropoda much longer than inner branch. First pair of antennæ reach the posterior angle of the first thoracic segment. Second pair reach the middle of the second thoracic segment. Sixth and seventh pair of legs show a marked disproportion in the length of the propodus.

Tecticeps alascensis Richardson, *A*, 9-106 fms. (See Fig. 8, p. 221.)

a'. Terminal segment of abdomen widely rounded. Outer branch of uropoda not longer than inner branch. First pair of antennæ reach the posterior angle of the third thoracic segment. Second pair of antennæ reach the middle of the fourth thoracic segment. Sixth and seventh pairs of legs show only a gradual increase in length.

Tecticeps convexus Richardson, *D*, 5 fms.

Genus *Dynamene* Leach.

a. Frontal margin of head produced in a quadrangular process ; first two joints of the first pair of antennæ dilated.

Dynamene dilatata Richardson, *D*, surface

a'. Frontal margin of head not produced ; joints of first pair of antennæ not dilated.

b. Abdomen tuberculated. Neither branch of the uropoda reaching the extremity of the abdomen.

Dynamene tuberculosa Richardson, *AD*, surface

b'. Abdomen not tuberculated. Inner branch of the uropoda reaching the extremity of the abdomen.

c. Ultimate segment of the abdomen ridged. Branches of uropoda of equal length. Sinus at extremity of abdomen funnel-shaped.

Dynamene benedicti Richardson, *D*, surface

c'. Ultimate segment of abdomen smooth. Outer branch of uropoda but little more than half as long as inner branch. Sinus at extremity of abdomen small.

Dynamene glabra Richardson, *D*, surface

Genus *Cilicæa* Leach.

a. Terminal segment with three sinuses, one above another in a longitudinal series, the two upper openings heart-shaped. Outer branch of the uropoda armed with four spines.

Cilicæa cordata Richardson, *A*, surface

a'. Terminal segment with one sinus. Outer branch of the uropoda unarmed.

b. Sinus without teeth. *Cilicæa carinata* Richardson, *S*, 440 fms.

b'. Sinus with teeth.

c. Sinus with four teeth. Median tubercle at base of terminal segment single. . . *Cilicæa caudata* (Say), *M*, surface

c'. Sinus with six teeth. Median tubercle at base of terminal segment double.

Cilicæa caudata gilliana Richardson, *D*

Genus *Næsa* Leach. *Næsa* (?) *depressa* Say, *M*, surface

Næsa (?) *ovalis* Say, *S*, surface

FAMILY XII. SEROLIDÆ.

Genus *Serolis* Leach.

Serolis carinata Lockington, *D*, 3 fms. (See Fig. 9, p. 225.)

III. VALVIFERA.

a. Body more or less broad, depressed. Legs usually nearly alike, but first three pairs sometimes with propodus dilated and dactylus reflexed.

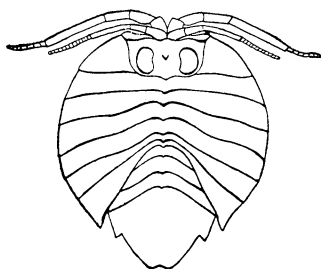
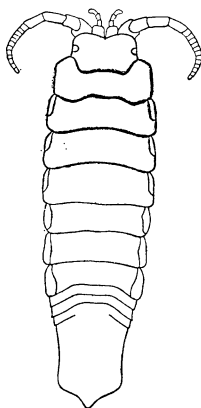
Family XIII. Idoteidæ

a'. Body narrow, scarcely depressed. Four anterior pairs of legs unlike three posterior pairs, and not ambulatory, nor strictly prehensile, directed forward, slender, ciliated, with terminal joint minute; last three pairs stouter, ambulatory, with terminal joint bifid.

Family XIV. Arcturidæ

FAMILY XIII. IDOTEIDÆ.

a. Sides of head emarginate or cleft and laterally produced beyond the eyes, which are situated upon its dorsal surface. Three anterior

FIG. 9. — *Serolis carinata*.FIG. 10. — *Idotea ochotensis*.

pairs of legs, with penultimate joint or propodus dilated, and forming, with reflexible dactylus, a prehensile hand. All the epimera distinct.

Chiridotea Harger

a'. Sides of head entire and not laterally produced. Eyes lateral. Legs all ambulatory; three anterior pairs with penultimate joint not or not much dilated.

b. Flagellum of second pair of antennæ well developed and multi-articulate.

c. Palpus of maxillipeds four-jointed. Epimera of all the segments well developed and evident in a dorsal view. Abdomen (including the terminal segment) consisting of three segments with lateral sutures, indicative of another partly coalescent segment. *Idotea* Fabricius

c'. Palpus of maxillipeds not four-jointed. Abdomen consisting of one segment, uniarticulate.

d. Palpus of maxillipeds three-jointed. All the epimera coalesced and perfectly united with the segments.

Synidotea Harger

d'. Palpus of maxillipeds two-jointed. Epimera of second, third, and fourth segments coalesced and perfectly united with the segments; those of the fifth, sixth, and seventh segments distinct and well developed.

Colidotea Richardson

b'. Flagellum of second pair of antennæ not multi-articulate.

c. Flagellum of second pair of antennæ rudimentary. Second pair of antennæ a little longer than first pair.

Edotea Guérin-Ménéville

c'. Flagellum of second pair of antennæ usually obsolete. Second pair of antennæ much longer than first pair.

- d.* Legs subequal. Antennæ geniculate. Palp of maxillipeds four-jointed. Body angulate.

Erichsonella Benedict

- d'.* Third and fourth pairs of legs usually markedly shorter. Fifth, sixth, and seventh pairs gradually increasing in length. Antennæ not geniculate. Palp of maxillipeds two-jointed. Body slender, linear, smooth.

Cleantis Dana

Genus Chiridotea Harger.

- a.* Species large, elongate-ovate. Outer branch of uropoda (or opercular valves) minute.

- b.* Joints of the peduncle of the antennæ not dilated; flagellum eight to fourteen-jointed. Antero-lateral cervical lobes prominent. . . *Chiridotea entomon* (Linn.), *AP*, surface to 15 fms.

- b'.* Joints of the peduncle of the antennæ greatly dilated; flagellum seven to eight-jointed. Antero-cervical lobes prominent.

Chiridotea sabinii (Krøyer), *AN*, surface to 15 fms.

- a'.* Species small, orbiculate-ovate. Outer branch of uropoda at least half as long as inner.

- b.* Antennæ little longer than antennulæ; flagellum seven-jointed. Eyes inconspicuous. Antennulæ longer than the peduncle of the antennæ. . . . *Chiridotea cæcas* (Say), *NMS*, surface

- b'.* Antennæ twice as long as antennulæ; flagellum twelve-jointed. Eyes usually distinct. Antennulæ do not surpass the peduncle of the antennæ.

Chiridotea tuftsii (Stimpson), *NM*, surface to 25 fms.

Genus Idotea Fabricius.

- a.* Terminal segment emarginate at its extremity.

Idotea resecata Stimpson, *AD*, surface

- a'.* Terminal segment not emarginate at its extremity.

- b.* Body slender, linear, filiform.

- c.* Terminal segment truncate at apex.

Idotea gracillima Dana, *D*

- c'.* Terminal segment not truncate at its extremity.

- d.* Post-lateral angles of terminal segment prominent and separated by a tooth from subtriangular middle portion, which bears a small tooth at the middle.

Idotea urotoma Stimpson, *P*

- d'.* Post-lateral angles not separated by a tooth from middle portion.

Idotea rectilineata Lockington, *D*, 30-40 fms.

- b'.* Body oblong-ovate.

- c.* Terminal segment truncate at its extremity.

Idotea metallica Bosc, *NM*, surface 91 fms.

- c'.* Terminal segment not truncate.

d. Terminal segment regularly and broadly rounded at its extremity, with small median tooth.

Idotea wosnesenskii Brandt, *APD*, surface to 9 fms.

d'. Terminal segment acute or distinctly toothed at its extremity.

e. With prominent post-lateral angles or teeth on either side of median tooth.

f. With acute lateral teeth.

Idotea marina (Linn.), *NM*, surface to 119 fms.

f'. With rounded lateral lobes.

g. Epimera of second, third, and fourth segments short, not reaching the post-lateral angles of their respective segments.

Idotea ochotensis Brandt, *A*, surface to 18 fms. (See Fig. 10, p. 225.)

g'. Epimera of all the segments reaching the post-lateral angles of their respective segments.

h. Sides of thorax arcuate.

Idotea stenops Benedict, *D*

h'. Sides of thorax more nearly parallel.

Idotea whitei Stimpson, *PD*

e'. With sides sloping regularly to produced extremity.

Idotea phosphorea Harger, *N*, surface to 18 fms.

Genus *Synidotea* Harger.

a. Terminal abdominal segment emarginate or notched at its extremity.

b. Two spines or tubercles overhanging the frontal notch.

c. Spines united near the base.

Synidotea pallida Benedict, *A*, 695 fms.

c'. Spines free at base.

Synidotea erosa Benedict, *A*, 483 fms.

b'. No spines or tubercles overhanging the frontal notch.

c. With a low ridge arising between the eyes and interrupted on the median line.

d. Outlines of abdomen subparallel.

Synidotea nebulosa Benedict, *A*, 9-32 fms.

d'. Outlines of abdomen strongly arcuate.

Synidotea angulata Benedict, *AP*, 31-38 fms.

c'. Without a ridge between the eyes.

d. Outline of abdomen subtriangular.

e. Front not excavated.

Synidotea consolidata (Stimpson), *P*

e'. Front excavated.

f. Outlines of thorax subparallel.

Synidotea marmorata (Packard), *N*, 36-129 fms.

f. Outlines of thorax strongly arcuate.

Synidotea bicuspidata (Owen), *AN*, 5-13½ fms.

d'. Outlines of abdomen rounded.

Synidotea laticauda Benedict, *A*, surface to 56 fms.

a'. Terminal abdominal segment pointed at its extremity.

b. Undulations of body not tubercular or spiny.

c. Tubercle in front of eyes not margined.

Synidotea nodulosa (Krøyer), *AN*, 16-119 fms.

c'. Tubercle on the frontal margin and forming a part of it.

Synidotea lævis Benedict, *A*, 29-36 fms.

b'. Undulations of the body tubercular and spiny.

c. Four spines on the front of the head; body spinous.

Synidotea muricata (Harford), *A*, 25 fms.

c'. A wedge-shaped tubercle behind the frontal notch; body tubercular. . . . *Synidotea picta* Benedict, *A*, 9 fms.

Genus *Colidotea* Richardson *Colidotea rostrata* (Benedict), *P*
Genus *Edotea* Guérin-Ménéville.

a. Anterior angles of head produced into horn-like projections. Lateral angles of thoracic segments produced into horn-like projections. Four tubercles situated on dorsal surface of head.

Edotea acuta Richardson, *N*, 105 fms.

a'. Anterior angles of head not produced into horn-like projections. Lateral angles of thoracic segments not produced into horn-like projections. Two tubercles situated on dorsal surface of head.

b. Lateral margins of thorax nearly even. Anterior angles of head not salient. Lateral margins of terminal segment scarcely indented.

Edotea triloba (Say), *NM*, surface to ½ fm.

b'. Lateral margins of thorax angulated and salient. Anterior angles of head salient. Lateral margins of terminal segment indented; terminal segment rather elongated.

Edotea montosa (Stimpson), *NM*, 2-40 fms.

Genus *Erichsonella* Benedict.

a. Surface of body smooth throughout. Outline of body regular. Antennulæ short. Terminal segment of body with but slight traces of a lateral tooth near its base on either side.

Erichsonella attenuata (Harger), *M*

a'. Surface of body tuberculated. Outline of body serrate. Antennulæ long. Terminal segment with a prominent lateral tooth near its base on either side. Large bifid tubercle on center of head. Median longitudinal row of tubercles on each thoracic segment.

Erichsonella filiformis (Say), *M*, 4½ to 7 fms.

Genus *Cleantis* Dana.

a. Flagellum consolidated and forming a single piece. Abdomen composed of four segments. Terminal abdominal segment with rounded

extremity; terminal portion of segment obliquely truncated, the oblique portion being surrounded by a raised margin.

Cleantis planicauda Benedict, *G*

- a'*. Flagellum composed of three joints. Abdomen composed of three segments. Terminal abdominal segment with acute post-lateral teeth on either side of rounded posterior portion. Surface of segment smooth throughout. *Cleantis heathii* Richardson, *D*

FAMILY XIV. ARCTURIDÆ.

- a*. Fourth segment of thorax not greatly longer than others. Marsupium of female composed of four pairs of plates. . . . *Arcturus* Latreille
- a'*. Fourth segment of thorax much longer than any of the others. Marsupium of female consisting of two plates affixed to this segment.

Astacilla Fleming

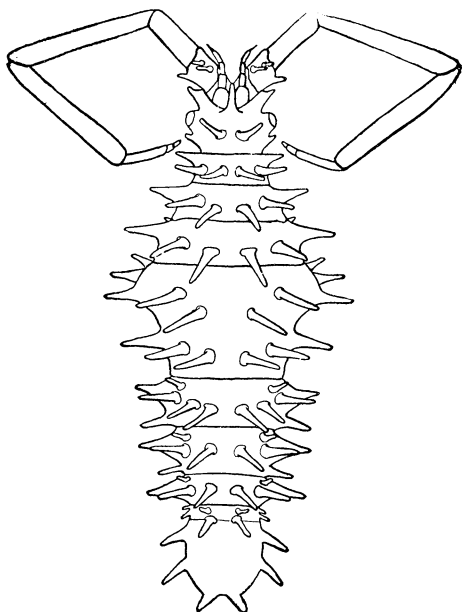


FIG. 11. — *Arcturus intermedius*.

Genus *Arcturus* Latreille.

- a*. End of terminal abdominal segment notched, as seen from above.
- b*. Body smooth and free from spines.

Arcturus beringanus Benedict, *A*, 29–36 fms.

- b'*. Body spiny.

- c*. Head and six segments of thorax, each with a pair of spines on the dorsum. Second and third articles of the antennæ without spines. *Arcturus longispinis* Benedict, *A*, 55 fms.

c'. Head and segments of thorax with not less than two pairs of spines to the segment.

d. Head with one large median spine on the anterior part of the head in front of the eyes.

Arcturus intermedius Richardson, *A*, 10 fms. (See Fig. 11, p. 229.)

d'. Head with three spines on anterior part of head in front of eyes.

Arcturus murchisoni Benedict, *A*, 13½ fms.

a'. End of terminal abdominal segment without notch.

b. Thorax without spines above the epimera.

Arcturus glaber Benedict, *A*, 55 fms.

b'. Thorax with spines above the epimera.

c. Terminal segment of abdomen armed with a long median terminal spine, projecting beyond the end of the segment.

Arcturus floridanus Richardson, *S*

c'. Terminal segment of abdomen not armed with long median terminal spine.

d. Four anterior segments of thorax with spines or tubercles. Middle surface of abdomen with prominent spiny projections. With conical lateral projections. Epimera pointed.

Arcturus baffini (Sabine), *N*, 110-150 fms.

d'. Four anterior segments of thorax without spines or tubercles. Middle surface of abdomen without any indication of prominent spiny projections. Without conical lateral projections. Epimera less pointed.

Arcturus feildeni Miers, *N*, 30 fms.

Genus *Astacilla* Fleming.

a. With eyes. Head excavate in front without rostriform point. Fourth thoracic segment subcylindrical. Terminal abdominal segment with a prominent, subacute tooth on each side, above the middle, directed outward and backward; extremity obtuse.

Astacilla granulata (G. O. Sars), *N*, 7-250 fms.

a'. Without eyes. Head with a rostriform point in front between the antennulæ. Fourth thoracic segment wider at the anterior end, and tapering to the posterior end. Terminal abdominal segment with a pair of teeth on each side; extremity acute.

Astacilla cæca Benedict, *N*, 1825 fms.